



US007761414B2

(12) **United States Patent**
Freedman

(10) **Patent No.:** **US 7,761,414 B2**
(45) **Date of Patent:** **Jul. 20, 2010**

(54) **ASYNCHRONOUS DATA
SYNCHRONIZATION AMONGST DEVICES**

(75) Inventor: **Gordon J. Freedman**, Palo Alto, CA
(US)

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 49 days.

(21) Appl. No.: **11/650,624**

(22) Filed: **Jan. 7, 2007**

(65) **Prior Publication Data**

US 2008/0168291 A1 Jul. 10, 2008

(51) **Int. Cl.**
G06F 7/00 (2006.01)
G06F 17/00 (2006.01)

(52) **U.S. Cl.** **707/610**

(58) **Field of Classification Search** None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,974,238 A	10/1999	Chase, Jr.
6,023,708 A	2/2000	Mendez et al.
6,034,621 A	3/2000	Kaufman
6,178,403 B1	1/2001	Detlef
6,269,405 B1	7/2001	Dutcher et al.
6,295,541 B1	9/2001	Bodnar et al.
6,393,434 B1	5/2002	Huang et al.
6,430,576 B1	8/2002	Gates et al.
6,564,261 B1 *	5/2003	Gudjonsson et al. 709/227
6,571,245 B2	5/2003	Huang et al.
6,708,221 B1	3/2004	Mendez et al.
6,789,258 B1	9/2004	Zak, Jr. et al.
6,985,912 B2	1/2006	Mullins et al.
6,990,513 B2	1/2006	Belfiore et al.
7,096,867 B2	8/2006	Smith et al.
7,100,039 B2	8/2006	Fisher et al.
7,188,193 B1	3/2007	Getsin et al.

7,200,668 B2	4/2007	Mak et al.
7,263,551 B2	8/2007	Belfiore et al.
7,401,104 B2	7/2008	Shah et al.
7,454,462 B2	11/2008	Belfiore et al.

(Continued)

FOREIGN PATENT DOCUMENTS

WO WO-03/073292 9/2003

(Continued)

OTHER PUBLICATIONS

Ori Shalev et al, "Predictive Log-Synchronization" ACM SIGOPS
Operating Systems Review, vol. 40, Issue 4, Oct. 2006, pp. 305-315.*

(Continued)

Primary Examiner—Uyen T. Le

(74) *Attorney, Agent, or Firm*—Blakely, Sokoloff, Taylor &
Zafman LLP

(57) **ABSTRACT**

Systems, methods and computer readable media for synchronization tasks and non-synchronization tasks being executed concurrently. In one exemplary embodiment, a method includes executing at least one user-level non-synchronization processing thread and executing at least one synchronization processing thread concurrently with the executing of the at least one user-level non-synchronization processing thread. The at least one user-level non-synchronization processing thread may include operations to access a first database which is synchronized by the at least one synchronization processing thread during a synchronization operation between the first database on a first processing system and a second database on a second data processing system.

32 Claims, 28 Drawing Sheets

